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# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

gts.2930.uk.ac.k

2. Patent application number

(The Patent Office will fill in this part)

0407756.6

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Richard A. Armell  
"Nuestro Casa"  
Kirkton St. Cyrus  
Montrose  
ANGUS  
DD10 0BW

ALVIN

A/L 19-5-04

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

8645921001

4. Title of the invention

Downhole tool

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Kennedys Patent Agency Limited  
Floor 5, Queens House  
29 St Vincent Place  
Glasgow  
G1 2DT

0805 824 0002

Patents ADP number (if you know it)

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

GB

0312899.8

05/06/03

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body.

See note (d))

No, Applicant is Inventor.

# Patents Form 1/77

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Continuation sheets of this form

Description 11

Claim(s) 3

Abstract 1

Drawing(s) 8 4 + 4



10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature Kennedy

Date

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05.04.04

12. Name and daytime telephone number of person to contact in the United Kingdom

Arlene Campbell

Tel: 0141 226 6826

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1    Downhole Tool

2

3    The present invention relates to centralisers used to  
4    centre tools in a tubular or well bore downhole. More  
5    specifically, the invention relates to an expandable  
6    centraliser which can centre a tool in an opening larger  
7    in diameter than a diameter through which the centraliser  
8    can freely pass.

9

10   When drilling or working on wellbores for use, for  
11   example, in oil and gas exploration, it is desirable to  
12   be able to increase the diameter of the well bore at a  
13   location within the well. This is typically done below a  
14   section of casing and thus a tool capable of being passed  
15   through the casing, which has a first diameter, and  
16   expanding to cut or mill out a bore having a diameter  
17   greater than the first diameter must be used. Such tools  
18   are referred to as underreamers.

19

20   Underreaming tools commonly comprise one or more pairs of  
21   cutting blades which are moveable from a retracted  
22   position to an extended position. The tool is maintained  
23   in the retracted position so that it may pass through the

1 casing, it is then moved to the extended position and  
2 held there by fluid pressure created in the drill string.  
3 A disadvantage of these tools is that the two blade  
4 arrangement provides 4 point contact on the walls of the  
5 wellbore which does not centralise the tool when the  
6 wellbore is inclined or horizontal.

7  
8 Centralisers are known for centering tools in a wellbore.  
9 The first type typically comprise a cylindrical body  
10 sized to have a diameter approximately equal to the  
11 diameter of the well bore at the location where the tool  
12 needs to be centred. Unfortunately these centralisers  
13 cannot pass through openings smaller than the diameter of  
14 the well bore at the location where the tool needs to be  
15 centred and therefore cannot be used to centre  
16 underreamers.

17  
18 A second class of centralisers comprise a cylindrical  
19 body having longitudinally arranged spring bows  
20 circumferentially around the body. These centralisers can  
21 pass through openings as small as the diameter of the  
22 body and then expand, by virtue of the bows, to  
23 centralise themselves and a drill string in well bores of  
24 larger diameters. However, due to the weight of the drill  
25 string, these centralisers tend to 'drop' to the low side  
26 of an inclined or horizontal well and thus lose their  
27 centering ability in these environments.

28  
29 It is an object of the present invention to provide a  
30 centraliser for centering a tool in an opening larger in  
31 diameter than the diameter of an opening through which  
32 the centraliser can freely pass.

33



1 It is a further object of the present invention to  
2 provide a centraliser which can centre a tool on a drill  
3 string in well bores of any inclination.

4  
5 It is a yet further object of the present invention to  
6 provide an expandable centraliser which can centralise a  
7 tool through a well bore of varying diameter.

8  
9 According to a first aspect of the present invention  
10 there is provided an expandable centraliser for centering  
11 a tool in a well bore having an opening larger in  
12 diameter than the diameter of an opening through which  
13 the centraliser can freely pass, the centraliser  
14 comprising a body connectable in a workstring, said body  
15 having a bore running axially therethrough, said body  
16 including a first portion being substantially cylindrical  
17 with a substantially circular cross-section of a first  
18 diameter and a second portion being polyhedral in cross-  
19 section to provide a plurality of faces parallel to said  
20 bore; a plurality of centralising members, each  
21 centralising member being located on a said face; and  
22 actuating means, said actuating means, on actuation,  
23 moving said centralising members from a first position  
24 within the first diameter to a second position wherein  
25 portions of said members are located outside the first  
26 diameter.

27  
28 Preferably the second position is variable depending on  
29 the actuation means and is preferably the diameter of the  
30 larger opening.

31  
32 Thus the centraliser is expandable so that the  
33 centralising members can remain within the first diameter

1 for the centraliser to pass through a small opening and  
2 can then be extended to contact a bore of a larger  
3 diameter and hence centralise the tool.

4  
5 Though the centraliser can operate with two centralising  
6 members it is more preferably that there are three or  
7 more centralising members. More preferably there are an  
8 odd number of centralising members. Advantageously there  
9 are three centralising members. This provides a simple  
10 mechanical design.

11  
12 Preferably the faces are identical and arranged  
13 equidistantly around the body. Advantageously there are  
14 three faces, providing a triangular cross-section, with a  
15 centralising member arranged on each face.

16  
17 Preferably each centralising member is pivoted against a  
18 face. Thus on actuation, each member swings across the  
19 face and extends from it. Preferably also a spring is  
20 located at each pivot such that each member is returned  
21 to the first position from the second position on removal  
22 of the actuation.

23  
24 Preferably the actuation means is a piston, the piston  
25 having a leading end arranged to contact an operating  
26 face of each centralising member, on actuation thereof.  
27 Preferably the piston is hydraulically actuated. More  
28 preferably the piston operates by differential fluid  
29 pressure created in the work string.

30  
31 The centraliser may include one or more intensifiers,  
32 each intensifier comprises a first face perpendicular to  
33 the bore having a surface area greater than an operating

1 surface area of the piston. Each intensifier may abut a  
2 first face of a neighbouring intensifier to provide a  
3 cascade. Preferably one intensifier is arranged to abut  
4 the operating surface area of the piston. In this way the  
5 centraliser can be operated in a work string having a low  
6 fluid pressure at the centraliser as would occur if the  
7 centraliser is located below a motor on the work string.

8  
9 Preferably the second portion is arranged on a  
10 cylindrical core of the body. In this way the first and  
11 second portions can rotate independently of each other.  
12 Thus in use, the first portion may rotate with the work  
13 string while the centralising members remain stationary  
14 in the wellbore.

15  
16 An embodiment of the present invention will now be  
17 described, by way of example only, with reference to the  
18 following drawings of which:

19  
20 Figure 1 is a cross-sectional view through an expandable  
21 centraliser according to the present invention;

22  
23 Figure 2 is an exploded view of the expandable  
24 centraliser of Figure 1;

25  
26 Figures 3(a) and (b) are part cross-sectional views  
27 through the expandable centraliser of Figure 1 with the  
28 centralising members in the (a) first and (b) second  
29 positions; and

30  
31 Figures 4(a) and (b) are views of the expandable  
32 centraliser of Figure 1 in the (a) first and (b) second  
33 positions.

1  
2 Referring initially to Figure 1, there is illustrated an  
3 expandable centraliser generally indicated by reference  
4 number 10 in accordance with an embodiment of the present  
5 invention. Centraliser 10 comprises a body 12 having a  
6 first portion 14 which is substantially cylindrical and  
7 defines the diameter of the centraliser 10. A further  
8 portion 16 comprises a sleeve 18 mounted over a narrow  
9 cylindrical portion 20. Mounted below the second portion  
10 16 is a third portion 22 which is also substantially  
11 cylindrical. At an upper end 24 of the centraliser 10  
12 there is located a connector 26 for connecting the  
13 centraliser 10 into a drill string (not shown). At a  
14 lower end 28 of the centraliser 10, there is located a  
15 threaded portion 30 for connecting the centraliser 10 to  
16 a lower portion of a drill string (not shown). It will  
17 be appreciated that the connectors 26, 28 can be used to  
18 connect the centraliser 10 to a tool within a drill  
19 string which requires to be centralised in the well bore.  
20

21 The remaining components of the centraliser 10 are best  
22 seen when Figure 1 is viewed in conjunction with Figure  
23 2. Figure 2 illustrates an exploded view of the  
24 centraliser 10 of Figure 1, like parts have been given  
25 the same reference number to aid clarity. Centraliser 10  
26 has an axial bore 32 passing through a centre axis from  
27 the upper end 24 to the lower end 28 of the centraliser  
28 10. Arranged from the lower end 28 there is located the  
29 connector 30 and above this rests a sub 34 located around  
30 the cylinder 20. Allen set screws 32 connect the sub 34  
31 to the cylinder 20 so that they can rotate together.  
32 Above the sub 34 is located a nylon spacer 38 protecting  
33 thrust ball bearings 40. The bearings provide for

1 rotation of the sleeve 18 on the sub 34. Sleeve 18 has  
2 an inner cylindrical surface 42. The inner surface 42  
3 provides a smooth sliding relationship with the narrow  
4 cylinder 20.

5  
6 The outer surface 44 of the sleeve 18 comprises a  
7 substantially triangular arrangement of three surfaces 46  
8 a, b, c providing an equilateral triangle on the outer  
9 surface 44 of the sleeve 18. Each face 46 a, b, c  
10 includes a pivot 48 on which a centralising member 50 a,  
11 b, c is located. A spring 52 located on the pivot 48 to  
12 bias the members 50 to a longitudinal position where they  
13 rest upon each face 46.

14  
15 Each centralising member 50 comprises a paddle having an  
16 aperture 54 for connection to the pivot 48, a rounded  
17 edge 56 and an upper actuating edge 58. Edge 58  
18 comprises two portions, a short planar portion 60 and a  
19 sloping portion 62. The members 50 can be made of any  
20 suitable material although they are preferably made of  
21 stainless steel. Further they may be of any shape which  
22 allows them, once arranged in a longitudinal position on  
23 the face 46, to reside within the diameter of the upper  
24 portion 14. The upper edge 58 of each member 50 rests  
25 above the face 46 so that they can be acted upon by a  
26 actuating surface 64.

27  
28 The actuating surface 64 is a lower face of the upper  
29 portion 14. Face 64 is arranged on a further nylon  
30 spacer 66 with equivalent thrust ball bearings 68. The  
31 face 64 can rotate independently of the sleeve 18 and  
32 members 50. Above the spacer 66 is arranged a cam 70  
33 which is acted upon by three cam pins 72 a, b, c. In the

1   embodiments shown, the cam pins 72 are attached to the  
2   cam 70 for ease of operation. The cam pins 72 are  
3   protected by an outer sleeve 74 arranged around the upper  
4   portion 14 of the centraliser 10.

5  
6   In the inner bore 32 above the cam pins 72 is located a  
7   piston 76. Piston 76 includes two pairs of seals, 78, 80  
8   to prevent fluid within the bore 32 leaking to other  
9   portions of the centraliser on the outer surface 82 of  
10   the piston 76. Piston 76 acts as an intensifier by  
11   having a narrow portion 84 and a broader portion 86. In  
12   this way an upper surface 88 is provided on the broader  
13   portion 86 with a large surface area on which fluid  
14   within the bore can act to operate the piston 76. It  
15   will be appreciated that further pistons of this design  
16   could be mounted above the piston 76, each with  
17   decreasing narrower portions 84 and substantially greater  
18   surface areas 88 so that fluid pressure on the upper  
19   surfaces 88 increases the effective pressure on each  
20   piston in turn.

21  
22   Reference is now made to Figures 3 and 4 of the drawings  
23   which illustrate the centraliser 10 in a first position  
24   and in a second position operating position. Like parts  
25   to those of Figures 1 and 2 have been given the same  
26   reference numeral to aid clarity. In use, sleeve 18 is  
27   located on cylinder 20 and the members 50 located on the  
28   pivots 48. Cam 70 rests between the sleeve 18 and the  
29   body 12 with the cam pins 72 inside the body 12 resting  
30   against the piston 76. Threaded connector 30 is  
31   connected to a drill string and preferably to a tool, for  
32   example an underreamer in the drill string. The upper

1 connector 26 is connected to the remaining drill string  
2 which may include a motor.

3

4 When in the well bore a low pressure is maintained  
5 through the bore 32 such that the piston 76 is not  
6 actuated. The cam 70 rests against the upper portion 14.  
7 In this position, each member 50 is arranged parallel  
8 with the bore 32 and remains substantially on a  
9 respective face 46. The upper surface 60 of the member  
10 50 rests against the actuating surface 64 of the above  
11 portion 14. In this position the centraliser can be run  
12 through a well bore casing which has a diameter equal to  
13 or greater than the diameter of the upper portion 14.

14

15 When the underreamer has reached a position for operation  
16 within the well bore, the underreamer can be centralised  
17 by increasing fluid pressure through the bore 32. An  
18 increase in fluid pressure provides a pressure  
19 differential across the surface 88 of the piston 76.  
20 Piston 76 is then forced downwards with the cam pins 72  
21 driving the cam 70 in a downward direction such that the  
22 actuating surface 64 contacts the surface 58 of each  
23 member 50. As the actuating surface 64 is moving towards  
24 the lower end 28 of the centraliser 10, the surface 58  
25 will run on the surface 64 such that the contact with the  
26 surface 58 will move from the small portion 60 to the  
27 larger surface 62 of the member 50. As this movement  
28 occurs the member 50 is forced to swing on the pivot 48  
29 so that it moves cross the face 46 and extends from the  
30 sleeve 18. A stop 90 limits the radial extension of each  
31 member 50 by abutting to the surface 64. All members 50  
32 a, b, c will move simultaneously as the piston 76 moves.  
33 It will be appreciated that the outer edge 94 of each

1 member 50 will also limit the radial extent of the  
2 centraliser as it abuts an inner surface of a casing or  
3 well bore. In this way the centraliser 10 can be used in  
4 a well bore casing of a variable diameter as each member  
5 50 can dynamically move in response to pressure applied  
6 at the surface 94. The pressure upon piston 76 ensures  
7 that the members 50 are always in their most radially  
8 extended position as required.

9

10 When work is finished in the well bore, pressure within  
11 the bore 32 is dropped and as a result the piston 76 is  
12 relaxed. The springs 52 move the members 50 back to  
13 their longitudinal positions on each of the faces 46 of  
14 the sleeve 18. The centraliser 10 can then be retracted  
15 with the underreamer back through a small diameter  
16 opening.

17

18 The principle advantage of the present invention is that  
19 it provides a centraliser for centring a tool in an  
20 opening larger diameter than the diameter of an opening  
21 through which the centraliser can pass freely.

22

23 A further advantage of the present invention is that it  
24 provides a centraliser which can centre a tool on a drill  
25 string in wells of any inclination. This is because the  
26 pressure applied on each of the surfaces 94 of the  
27 members 50 is uniform and the members 50 are therefore  
28 not inclined to drop to a lower side of the well bore.

29

30 It is a yet further advantage of the present invention in  
31 providing a centraliser which can centralise a tool in  
32 varying diameters of a well bore.

33



1 Various modifications may be made to the invention here  
2 in described without departing from the scope thereof.  
3 For instance though only three member 50 are shown on the  
4 embodiment described it will be appreciated that any odd  
5 number of members 50 may be used. Additionally, the only  
6 single piston 76 is shown, identical pistons having  
7 greater surface areas 88 can be sat up the piston 76 to  
8 provide one or more intensifiers.

1   Claims:

2

3   1.   An expandable centraliser for centering a tool in a  
4       well bore having an opening larger in diameter than  
5       the diameter of an opening through which the  
6       centraliser can freely pass, the centraliser  
7       comprising a body connectable in a workstring, said  
8       body having a bore running axially therethrough,  
9       said body including a first portion being  
10      substantially cylindrical with a substantially  
11      circular cross-section of a first diameter and a  
12      second portion being polyhedral in cross-section to  
13      provide a plurality of faces parallel to said bore;  
14      a plurality of centralising members, each  
15      centralising member being located on a said face;  
16      and actuating means, said actuating means, on  
17      actuation, moving said centralising members from a  
18      first position within the first diameter to a second  
19      position wherein portions of said members are  
20      located outside the first diameter.

21

22   2.   An expandable centraliser as claimed in Claim 1  
23       wherein the second position is variable depending on  
24       the actuation means.

25

26   3.   An expandable centraliser as claimed in Claim 1 or  
27       Claim 2 wherein there are three or more centralising  
28       members.

29

30   4.   An expandable centraliser as claimed in Claim 3  
31       wherein there are an odd number of centralising  
32       members.

33

- 1 5. An expandable centraliser as claimed in any  
2 preceding Claim wherein the faces are identical and  
3 arranged equidistantly around the body.  
4
- 5 6. An expandable centraliser as claimed in Claim 5  
6 wherein there are three faces, providing a  
7 triangular cross-section, with a centralising member  
8 arranged on each face.  
9
- 10 7. An expandable centraliser as claimed in any  
11 preceding Claim wherein each centralising member is  
12 pivoted against a face.  
13
- 14 8. An expandable centraliser as claimed in Claim 7  
15 wherein a spring is located at each pivot such that  
16 each member is returned to the first position from  
17 the second position on removal of the actuation.  
18
- 19 9. An expandable centraliser as claimed in any  
20 preceding Claim wherein the actuation means is a  
21 piston, the piston having a leading end arranged to  
22 contact an operating face of each centralising  
23 member, on actuation thereof.  
24
- 25 10. An expandable centraliser as claimed in Claim 9  
26 wherein the piston is hydraulically actuated.  
27
- 28 11. An expandable centraliser as claimed in Claim 10  
29 wherein the piston operates by differential fluid  
30 pressure created in the work string.  
31
- 32 12. An expandable centraliser as claimed in any  
33 preceding Claim wherein the centraliser includes one  
34 or more intensifiers, each intensifier comprising a

1 first face perpendicular to the bore having a  
2 surface area greater than an operating surface area  
3 of the piston.  
4

5 13. An expandable centraliser as claimed in Claim 12  
6 wherein each intensifier abuts a first face of a  
7 neighbouring intensifier to provide a cascade, and  
8 wherein one intensifier is arranged to abut the  
9 operating surface area of the piston.  
10

11 14. An expandable centraliser as claimed in any  
12 preceding Claim wherein the second portion is  
13 arranged on a cylindrical core of the body so that  
14 the first and second portions can rotate  
15 independently of each other.  
16

1 Abstract:

2

3 An expandable centraliser, having a body with a first  
4 portion of circular cross-section and a second of  
5 polyhedral cross-section. Plates are arranged on faces  
6 of the polyhedral portion which, in a first position,  
7 limit the diameter of the tool so that it may pass  
8 through small openings in a well bore. The plates can  
9 then move across the faces hydraulically, to extend and  
10 provide supports for the centraliser in larger openings  
11 within the well bore.

12

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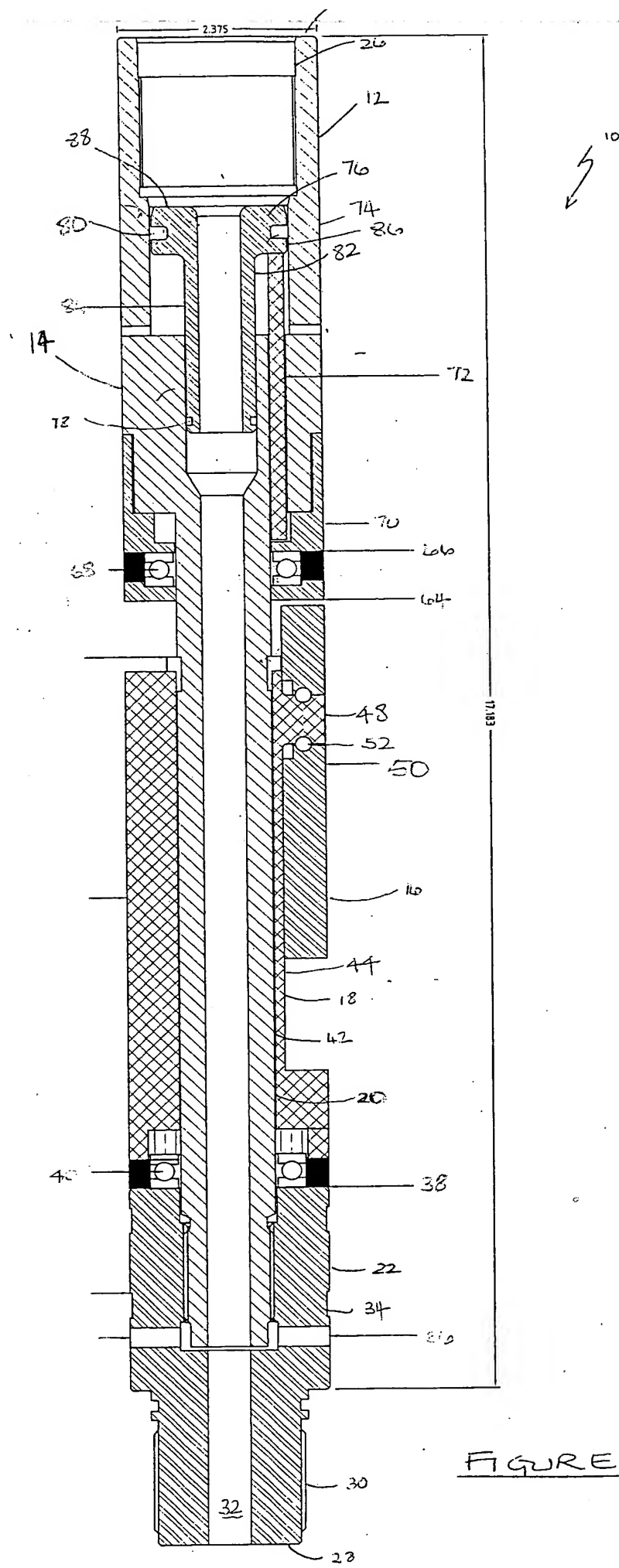


FIGURE 1

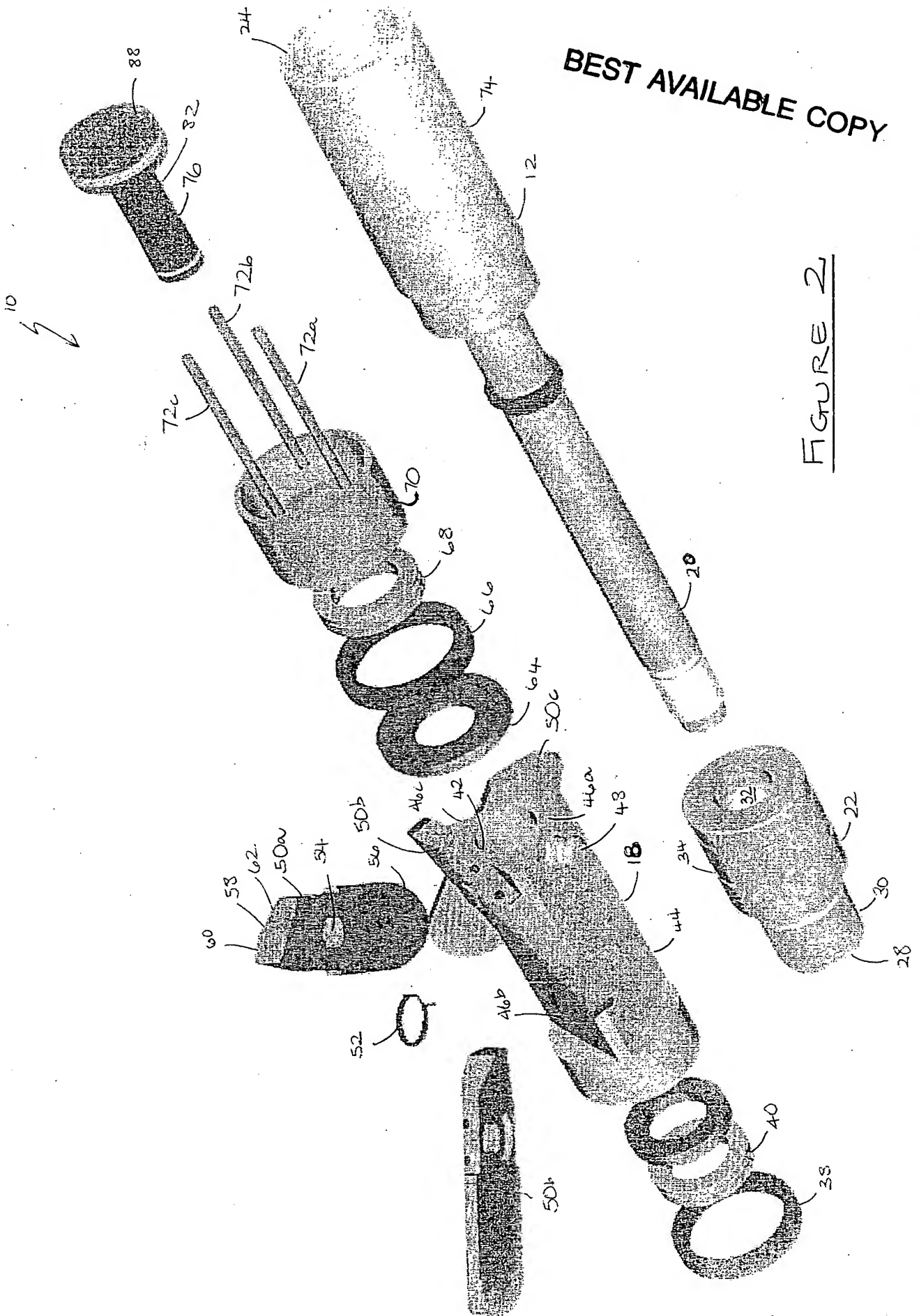
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Figure 2



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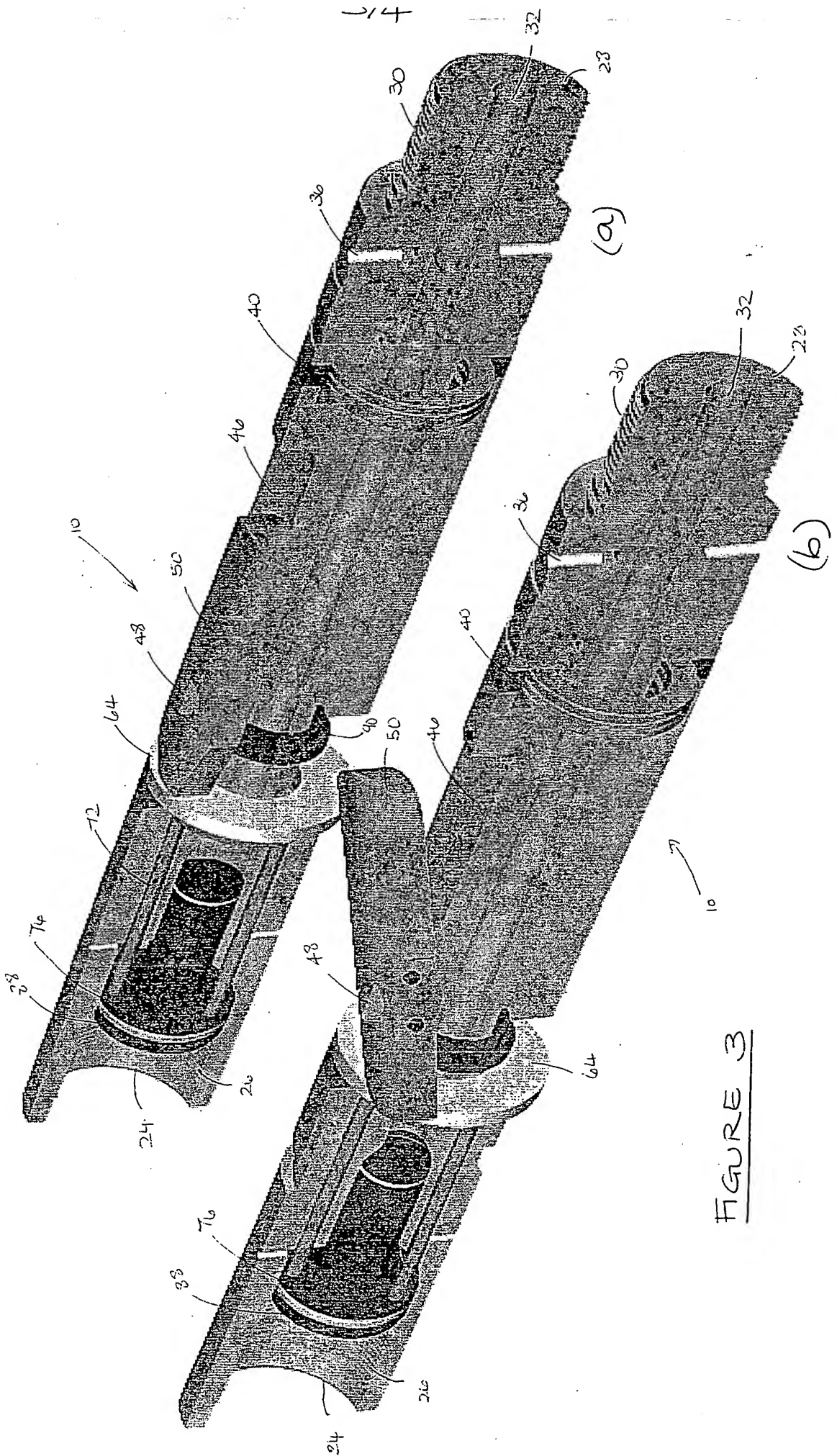
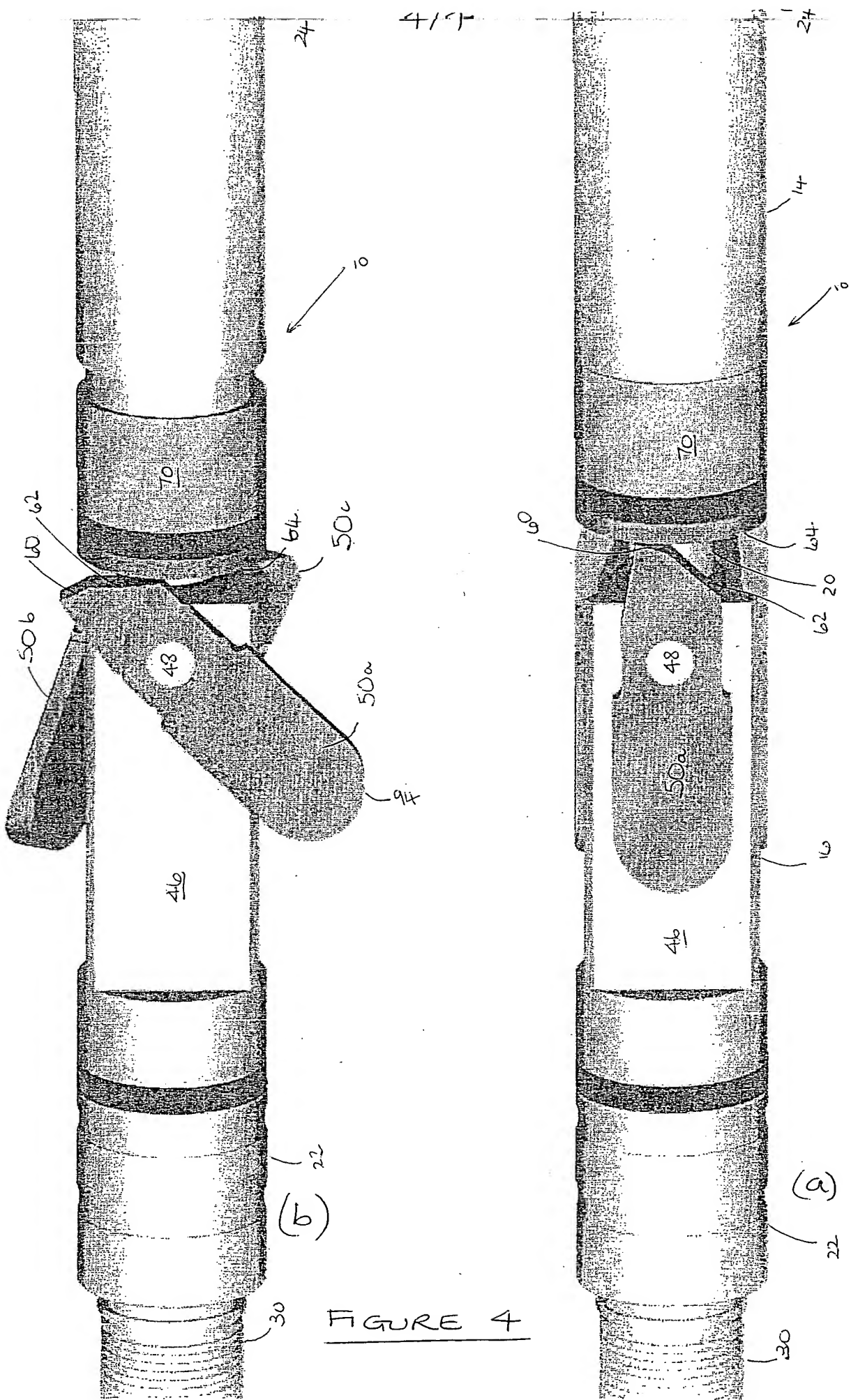


FIGURE 3

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